

What Is Claimed Is:

1 1. A method for manipulating a window within a three-dimensional
2 (3D) display model, comprising:
3 receiving an input from a 2D pointing device, wherein the input specifies a
4 2D offset within a 2D display, wherein the 2D display provides a view into the 3D
5 display model;
6 using the 2D offset to move a cursor to a position in the 2D display;
7 determining if the cursor overlaps a window within the 3D display model;
8 and
9 if the cursor overlaps a window,
10 determining a 2D position of the cursor with respect to a
11 2D coordinate system for the window, and
12 communicating the 2D position to an application associated
13 with the window to enable a user of the 2D pointing device to
14 interact with the application.

1 2. The method of claim 1, wherein determining if the cursor overlaps
2 a window within the 3D display model involves:
3 projecting a ray from a predefined viewpoint in the 3D display model
4 through the cursor, which is located in a rectangle representing the 2D display in
5 the 3D display model, toward one or more windows in the 3D display model; and
6 determining if the ray intersects a window.

1 3. The method of claim 2, wherein determining the 2D position of the
2 cursor with respect to the 2D coordinate system of the window involves:

3 determining a 3D position where the ray intersects the window within the
4 3D display model; and
5 transforming the 3D position in the 3D display model into a 2D position
6 with respect to the 2D coordinate system for the window based upon the size,
7 position and orientation of the window within the 3D display model.

1 4. The method of claim 3, wherein the size, position and orientation
2 of the window within the 3D display model are specified by a number of attributes
3 of the window, including:
4 a height;
5 a width;
6 an x-position;
7 a y-position;
8 a z- position;
9 a first rotation around a vertical axis of the window; and
10 a second rotation around a horizontal axis of the window.

1 5. The method of claim 1, further comprising:
2 receiving a second input from the 2D pointing device; and
3 in response to the second input, changing a viewing angle for the 3D
4 display model by rotating objects within the 3D display model around a
5 predefined viewpoint.

1 6. The method of claim 1, wherein if the cursor overlaps a given
2 window, the given window becomes a selected window and appears opaque while
3 other windows within the 3D display model appear translucent.

1 7. The method of claim 1, wherein if a command is received to
2 minimize a window, the window minimization operation is illustrated as an
3 animation that moves the window toward a minimized position near a border of
4 the 2D display while reducing the size of the window to its minimized size.

1 8. The method of claim 1, wherein if a command is received to close
2 a window, the window closing operation is illustrated as an animation that throws
3 the window away by moving the window toward the background of the 3D
4 display model and causing the window to fade away.

1 9. The method of claim 1, wherein if a command is received to rotate
2 all windows in the 3D display model, the method further comprises rotating all
3 windows in the 3D display model, so that windows are viewed from an oblique
4 angle through the 2D display, whereby the contents of the windows remain
5 visible, while the windows occupy less space in the 2D display and are less likely
6 to overlap each other.

1 10. The method of claim 9, wherein when a window is rotated, a spine
2 located on a side edge of the window becomes visible, wherein the spine contains
3 identification information for the window.

1 11. The method of claim 9, wherein when a user selects one of the
2 rotated windows, the method further comprises:
3 moving the selected window in front of the other windows;
4 unrotating the selected window so it faces the user; and
5 moving the other windows back to their original positions and
6 orientations.

1 12. The method of claim 1, wherein the 2D pointing device can
2 include:
3 a mouse;
4 a track ball;
5 a joystick; and
6 a glide point.

1 13. A computer-readable storage medium storing instructions that
2 when executed by a computer cause the computer to perform a method for
3 manipulating a two-dimensional (2D) window within a three-dimensional (3D)
4 display model, the method comprising:
5 receiving an input from a 2D pointing device, wherein the input specifies a
6 2D offset within a 2D display, wherein the 2D display provides a view into the 3D
7 display model;
8 using the 2D offset to move a cursor to a position in the 2D display;
9 determining if the cursor overlaps a window within the 3D display model;
10 and
11 if the cursor overlaps a window,
12 determining a 2D position of the cursor with respect to a
13 2D coordinate system for the window, and
14 communicating the 2D position to an application associated
15 with the window to enable a user of the 2D pointing device to
16 interact with the application.

1 14. The computer-readable storage medium of claim 13, wherein
2 determining if the cursor overlaps a window within the 3D display model
3 involves:

4 projecting a ray from a predefined viewpoint in the 3D display model
5 through the cursor, which is located in a rectangle representing the 2D display in
6 the 3D display model, toward one or more windows in the 3D display model; and
7 determining if the ray intersects a window.

1 15. The computer-readable storage medium of claim 14, wherein
2 determining the 2D position of the cursor with respect to the 2D coordinate
3 system of the window involves:

4 determining a 3D position where the ray intersects the window within the
5 3D display model; and
6 transforming the 3D position in the 3D display model into a 2D position
7 with respect to the 2D coordinate system for the window based upon the size,
8 position and orientation of the window within the 3D display model.

1 16. The computer-readable storage medium of claim 15, wherein the
2 size, position and orientation of the window within the 3D display model are
3 specified by a number of attributes of the window, including:

4 a height;
5 a width;
6 an x-position;
7 a y-position;
8 a z- position;
9 a first rotation around a vertical axis of the window; and
10 a second rotation around a horizontal axis of the window.

1 17. The computer-readable storage medium of claim 13, wherein the
2 method further comprises:

3 receiving a second input from the 2D pointing device; and
4 in response to the second input, changing a viewing angle for the 3D
5 display model by rotating objects within the 3D display model around a
6 predefined viewpoint.

1 18. The computer-readable storage medium of claim 13, wherein if the
2 cursor overlaps a given window, the given window becomes a selected window
3 and appears opaque while other windows within the 3D display model appear
4 translucent.

1 19. The computer-readable storage medium of claim 13, wherein if a
2 command is received to minimize a window, the window minimization operation
3 is illustrated as an animation that moves the window toward a minimized position
4 near a border of the 2D display while reducing the size of the window to its
5 minimized size.

1 20. The computer-readable storage medium of claim 13, wherein if a
2 command is received to close a window, the window closing operation is
3 illustrated as an animation that throws the window away by moving the window
4 toward the background of the 3D display model and causing the window to fade
5 away.

1 21. The computer-readable storage medium of claim 13, wherein if a
2 command is received to rotate all windows in the 3D display model, the method

3 further comprises rotating all windows in the 3D display model, so that windows
4 are viewed from an oblique angle, whereby the contents of the windows remain
5 visible, while the windows occupy less space in the 2D display and are less likely
6 to overlap each other.

1 22. The computer-readable storage medium of claim 21, wherein when
2 a window is rotated, a spine located on a side edge of the window becomes
3 visible, wherein the spine contains identification information for the window.

1 23. The computer-readable storage medium of claim 21, wherein when
2 a user selects one of the rotated windows, the method further comprises:
3 moving the selected window in front of the other windows;
4 unrotating the selected window so it faces the user; and
5 moving the other windows back to their original positions and
6 orientations.

1 24. The computer-readable storage medium of claim 13, wherein the
2 2D pointing device can include:
3 a mouse;
4 a track ball;
5 a joystick; and
6 a glide point.

1 25. An apparatus that manipulates a two-dimensional (2D) window
2 within a three-dimensional (3D) display model, comprising:

3 an input mechanism configured to receive an input from a 2D pointing
4 device, wherein the input specifies a 2D offset within a 2D display, wherein the
5 2D display provides a view into the 3D display model;
6 a cursor mechanism configured to use the 2D offset to move a cursor to a
7 position in the 2D display; and
8 a window manipulation mechanism configured to determine if the cursor
9 overlaps a window within the 3D display model;
10 wherein if the cursor overlaps a window, the window manipulation
11 mechanism is configured to,
12 determine a 2D position of the cursor with respect to a 2D
13 coordinate system for the window, and to
14 communicate the 2D position to an application associated
15 with the window to enable a user of the 2D pointing device to
16 interact with the application.

1 26. The apparatus of claim 25, wherein while determining if the cursor
2 overlaps a window within the 3D display model, the window manipulation
3 mechanism is configured to:
4 project a ray from a predefined viewpoint in the 3D display model through
5 the cursor, which is located in a rectangle representing the 2D display in the 3D
6 display model, toward one or more windows in the 3D display model; and to
7 determine if the ray intersects a window.

1 27. The apparatus of claim 26, wherein while determining the 2D
2 position of the cursor with respect to the 2D coordinate system of the window, the
3 window manipulation mechanism is configured to:

4 determine a 3D position where the ray intersects the window within the 3D
5 display model; and to
6 transform the 3D position in the 3D display model into a 2D position with
7 respect to the 2D coordinate system for the window based upon the size, position
8 and orientation of the window within the 3D display model.

1 28. The apparatus of claim 27, wherein the size, position and
2 orientation of the window within the 3D display model are specified by a number
3 of attributes of the window, including:
4 a height;
5 a width;
6 an x-position;
7 a y-position;
8 a z- position;
9 a first rotation around a vertical axis of the window; and
10 a second rotation around a horizontal axis of the window.

1 29. The apparatus of claim 25, further comprising a viewing angle
2 changing mechanism configured to:
3 receive a second input from the 2D pointing device; and
4 in response to the second input, to change a viewing angle for the 3D
5 display model by rotating objects within the 3D display model around a
6 predefined viewpoint.

1 30. The apparatus of claim 25, wherein if the cursor overlaps a given
2 window, the window manipulation mechanism is configured to make the given a

3 selected window that appears opaque while other windows within the 3D display
4 model appear translucent.

1 31. The apparatus of claim 25, wherein if a command is received to
2 minimize a window, the window manipulation mechanism is configured to
3 illustrate the minimization operation as an animation that moves the window
4 toward a minimized position near a border of the 2D display while reducing the
5 size of the window to its minimized size.

1 32. The apparatus of claim 25, wherein if a command is received to
2 close a window, the window manipulation mechanism is configured to illustrate
3 the window closing operation as an animation that throws the window away by
4 moving the window toward the background of the 3D display model and causing
5 the window to fade away.

1 33. The apparatus of claim 25, wherein if a command is received to
2 rotate all windows in the 3D display model, the window manipulation mechanism
3 is configured to rotate all windows in the 3D display model, so that windows are
4 viewed from an oblique angle through the 2D display, whereby the contents of the
5 windows remain visible, while the windows occupy less space in the 2D display
6 and are less likely to overlap each other.

1 34. The apparatus of claim 33, wherein when a window is rotated, a
2 spine located on a side edge of the window becomes visible, wherein the spine
3 contains identification information for the window.

1 35. The apparatus of claim 33, wherein when a user selects one of the
2 rotated windows, the window manipulation mechanism is configured to:
3 move the selected window in front of the other windows;
4 unrotate the selected window so it faces the user; and to
5 move the other windows back to their original positions and orientations.

1 36. The apparatus of claim 25, wherein the 2D pointing device can
2 include:
3 a mouse;
4 a track ball;
5 a joystick; and
6 a glide point.

1 37. A means for manipulating a two-dimensional (2D) window within
2 a three-dimensional (3D) display model, comprising:
3 an input means for receiving an input from a 2D pointing device, wherein
4 the input specifies a 2D offset within a 2D display, wherein the 2D display
5 provides a view into the 3D display model;
6 a cursor means configured to use the 2D offset to move a cursor to a
7 position in the 2D display; and
8 a window manipulation means configured to determine if the cursor
9 overlaps a window within the 3D display model;
10 wherein if the cursor overlaps a window, the window manipulation means
11 is configured to,
12 determine a 2D position of the cursor with respect to a 2D
13 coordinate system for the window, and to

14 communicate the 2D position to an application associated
15 with the window to enable a user of the 2D pointing device to
16 interact with the application.